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PATENTED NOV. 15, 1904.

A. J. WURTS.

SYSTEM OF DISTRIBUTION FOR ELECTRIC GLOWER LAMPS.

APPLICATION FILED NOV. 9, 1900.

NO MODEL.

2 SHEETS—SHEET 1.

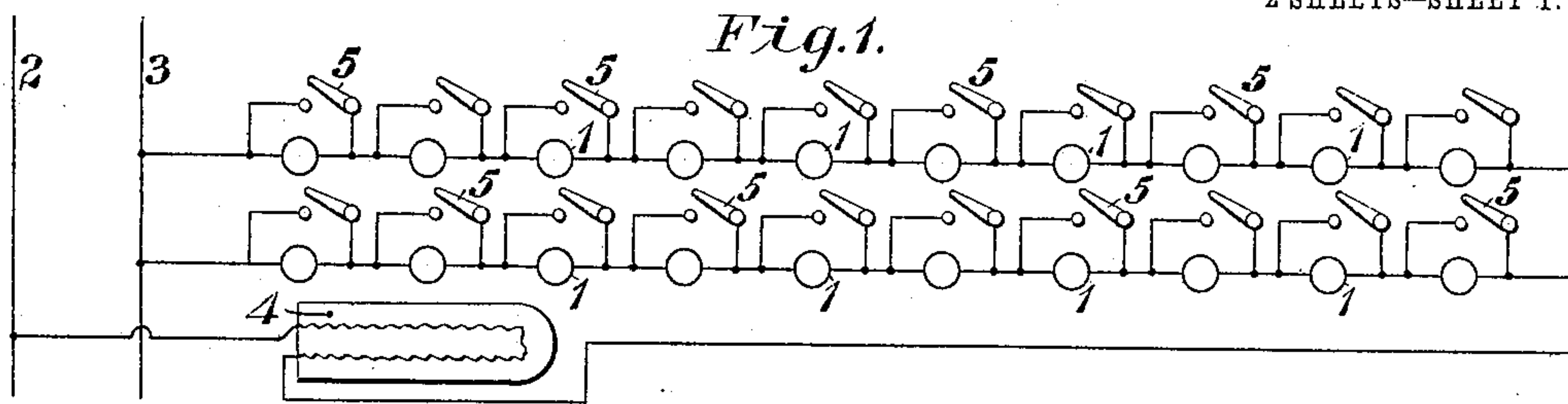


Fig. 2.

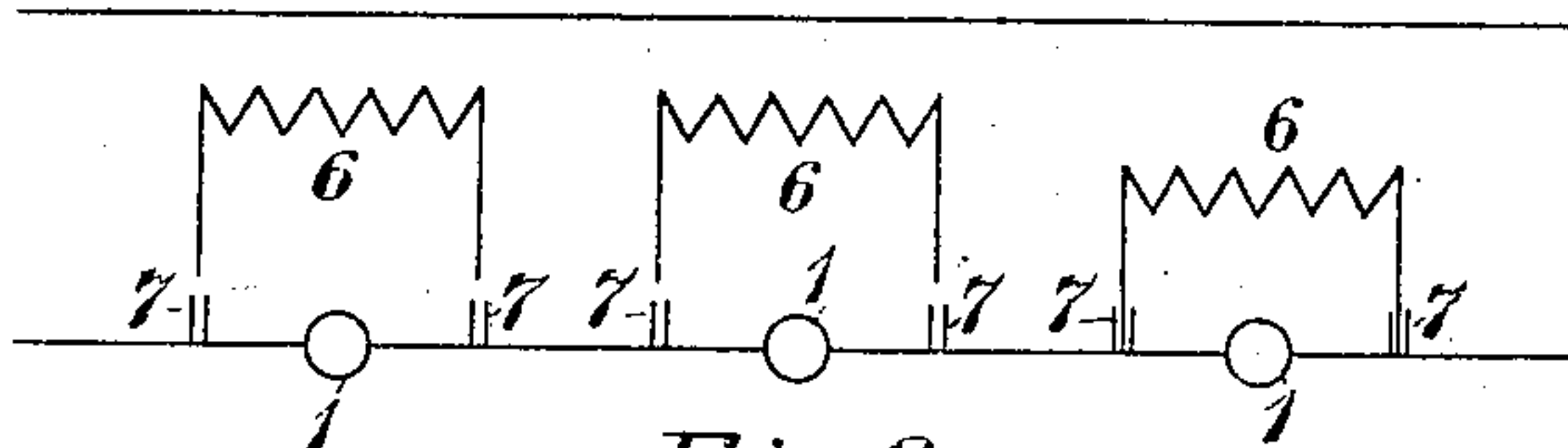


Fig. 3.

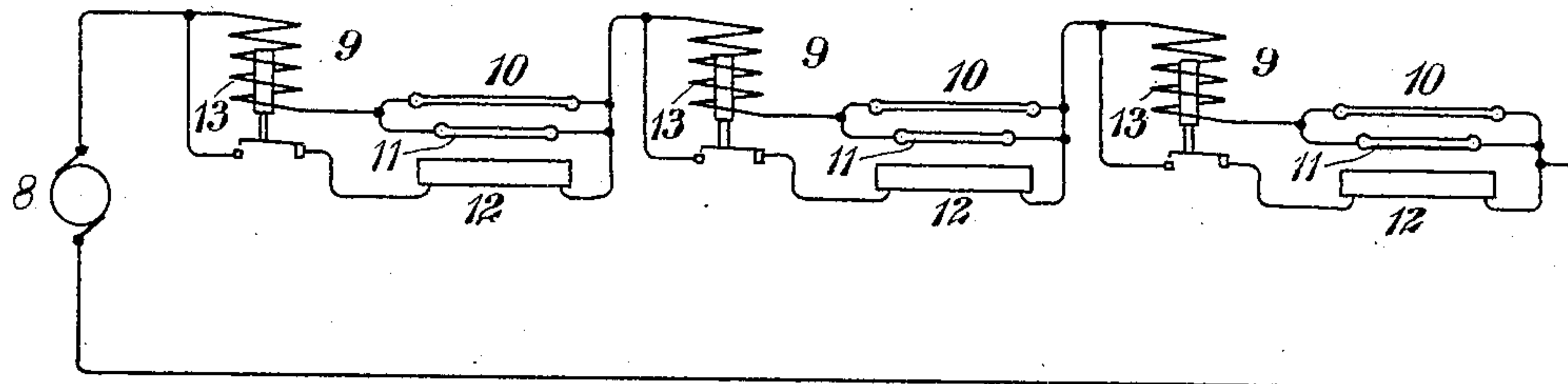
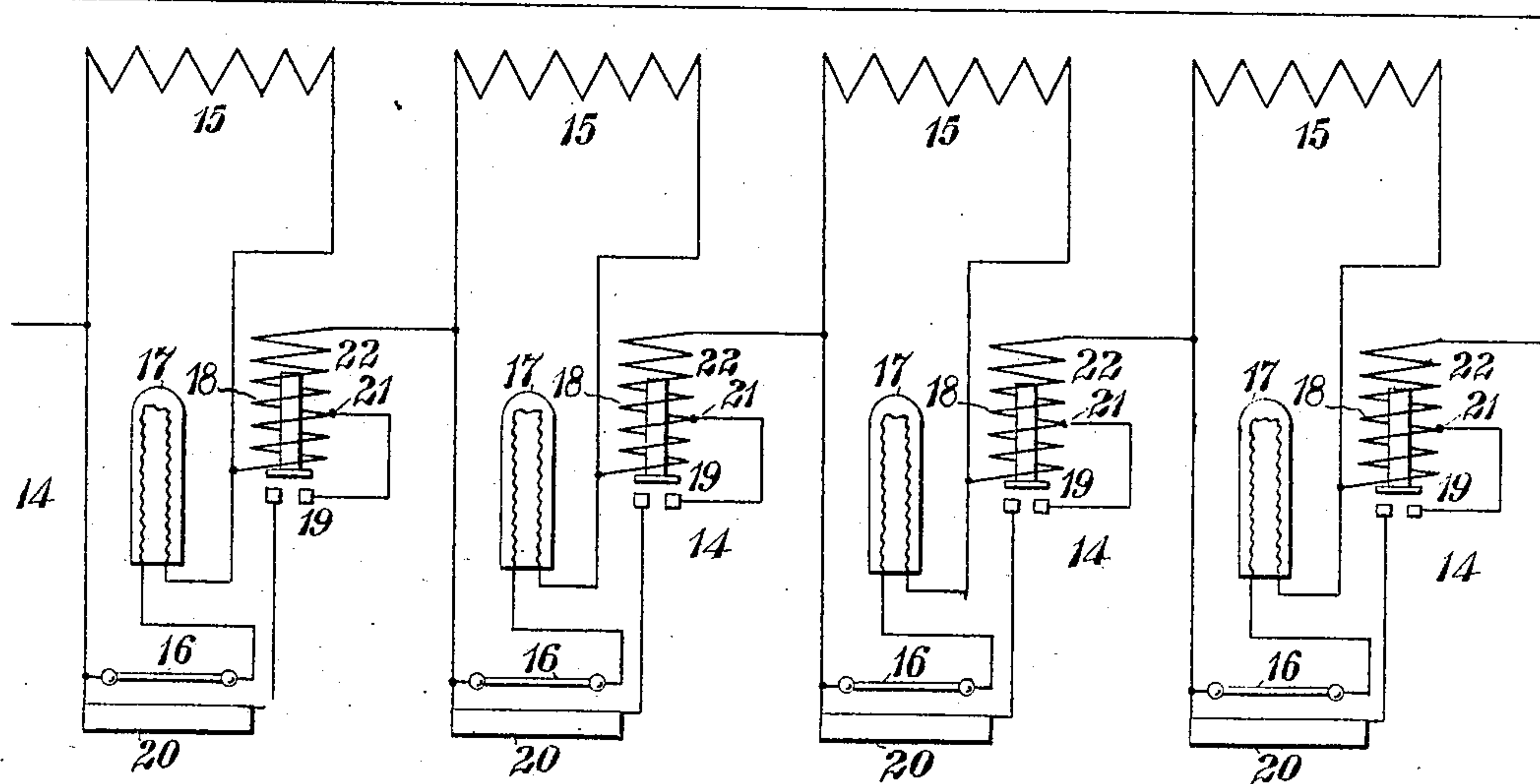


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

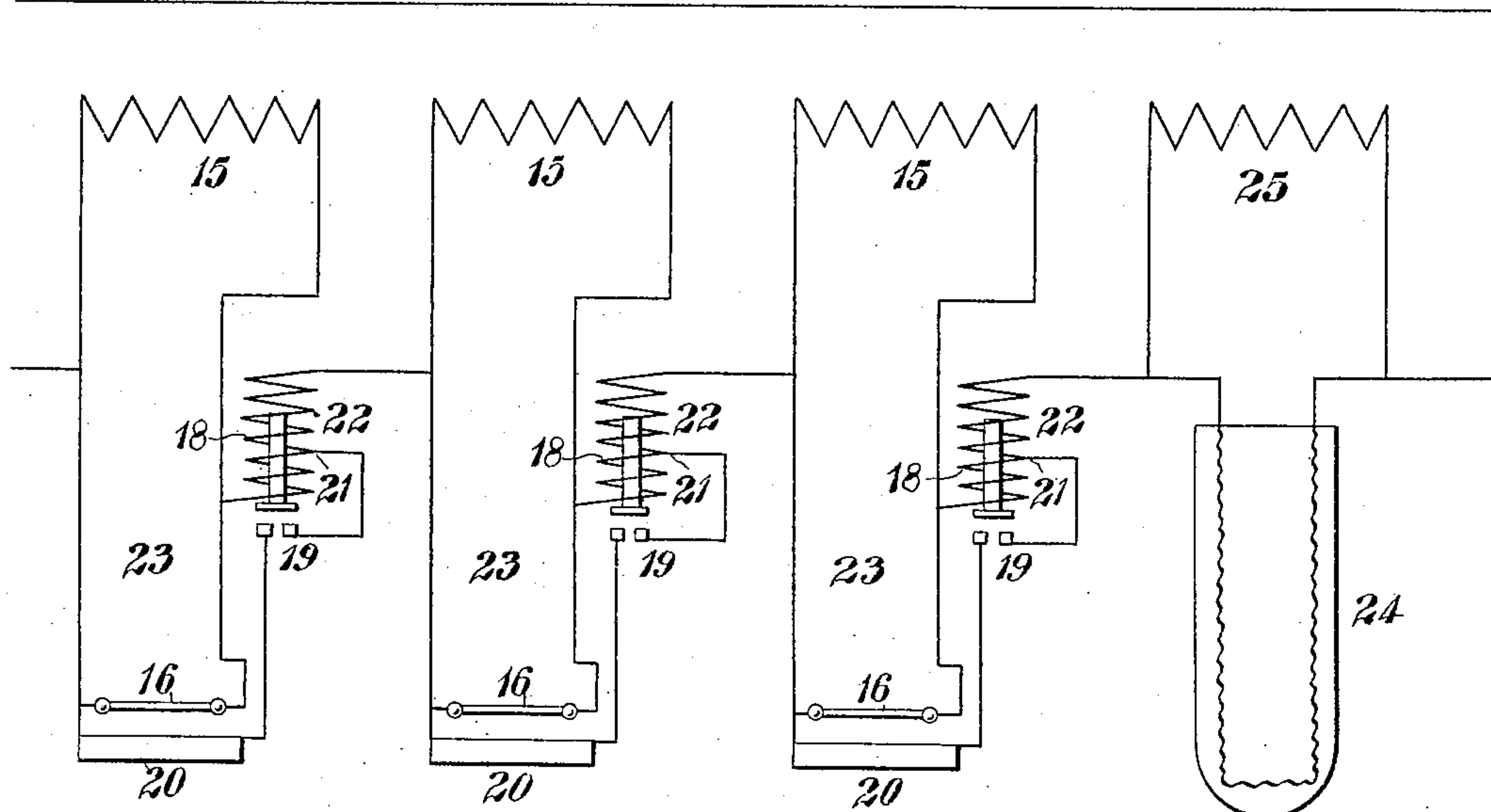
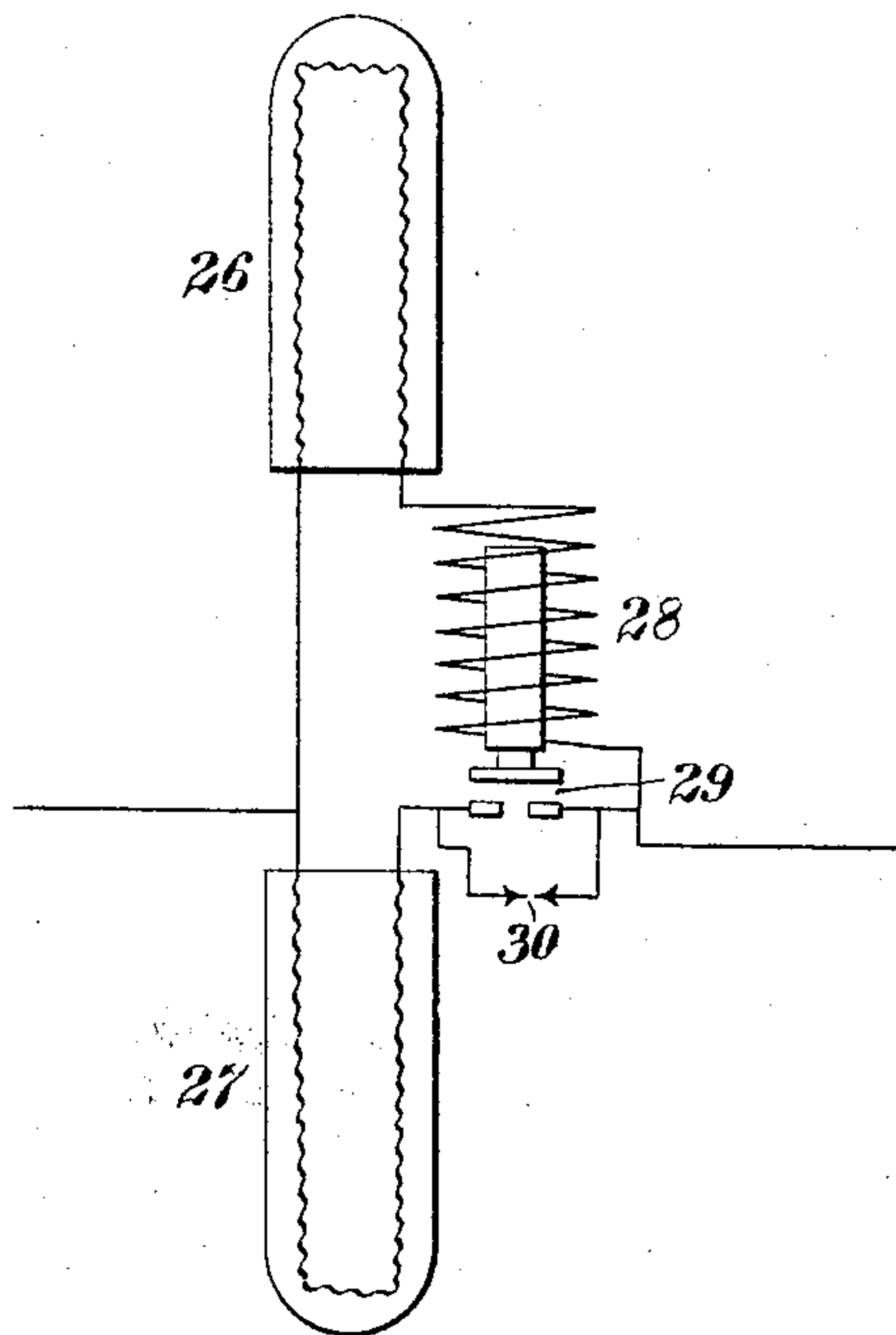


Fig. 6.



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SYSTEM OF DISTRIBUTION FOR ELECTRIC GLOWER-LAMPS.

SPECIFICATION forming part of Letters Patent No. 774,812, dated November 15, 1904.

Application filed November 9, 1900. Serial No. 35,990. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER JAY WURTS, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Systems of Distribution for Electric Glower-Lamps, of which the following is a specification.

My invention relates to electric glower-lamps and the operation of such lamps in series on either constant-potential or constant-current circuits.

The object of my invention is to provide a construction and arrangement of apparatus whereby glower-lamps may be operated satisfactorily and efficiently in series and so that no serious interruption of the service will occur in case one or more of the glowers becomes burned out or otherwise destroyed.

With this end in view I have devised the means shown in the accompanying drawings, in which—

Figure 1 is a diagram illustrating the operation of a plurality of lamps in multiple series from constant-potential mains and provided with a single ballast resistance. Fig. 2 is a diagram of a plurality of lamps connected in series and each provided with a removable shunt resistance. Fig. 3 is a diagram illustrating a plurality of lamps connected in series in a constant-current circuit and provided with means for preventing interruption of the service when the active glower of any lamp becomes destroyed. Fig. 4 is a diagram of a plurality of lamps connected in series and each provided with a shunt resistance and a ballast resistance. Fig. 5 is a diagram illustrating a series of lamps and a single ballast resistance for all of the lamps, each lamp and the ballast resistance having its own shunt-resistance coil. Fig. 6 is a diagram of a magazine-ballast device for use in connection with a set of lamps connected in series.

Referring now particularly to Fig. 1, the lamps 1 are shown as arranged in two sets, the lamps of each set being connected in series with each other, but the two sets being in parallel and supplied with current from con-

stant-potential mains 2 and 3. A single ballast resistance 4 is provided for all of the lamps of the two sets, and each lamp is provided with a switch 5, so located as to provide a shunt-path around the lamp when desired. Where the series-connected lamps are supplied by current at a constant potential, as indicated in Fig. 1, a shunt resistance is unnecessary, since upon interruption of the circuit by the burning out of a glower or its destruction from any other cause the heater will be automatically cut in and allow the remaining lamps to continue in service, the heater thus taking the place of the broken glower and remaining in circuit until the glower is replaced. As shown in Fig. 1, however, the switch 5, with which each of the lamps is provided, may be closed for the purpose of maintaining the continuity of the circuit while the defective lamp is removed for repairs instead of depending upon the heater for maintaining the circuit.

As regards the use of a single ballast for a plurality of lamps, it obviously is not feasible to employ such a ballast where two lamps only are operated in parallel, because one lamp might burn out, and thus leave the ballast out of proportion for a single lamp; but with two sets of lamps, as shown in Fig. 1, there is no likelihood that either of the sets will be extinguished for more than a fraction of a second—that is, during the interval between the burning out of a glower and the cutting in of its heater, and consequently the system will be satisfactorily operative, as shown.

Referring now to Fig. 2, the lamps 1 are connected in series and may each be provided with a choke-coil or other convenient form of resistance 6, connected in shunt to the lamp, clips or sockets 7 being provided to receive the terminals of the coils 6, thus insuring ready removability of the shunt-coils. Any other form of switch connection may obviously be employed, if desired. Under normal operating conditions the shunt resistance may be removed and need be replaced only when the glower of the corresponding lamp is

burned out, thereby substituting an equivalent resistance for the lamp during the time that the latter is removed. The advantage of this arrangement over that indicated in Fig. 1 is that not only is the circuit maintained, but the current is also maintained at a constant value. The replacing of a broken glower might of course be effected without employing either the shunt resistance 6 of Fig. 2 or the switch 5 of Fig. 1; but in such case it would be necessary to remove the defective lamp from the circuit, and this would temporarily interrupt the service.

Referring now to Fig. 3, the generator 8 for supplying the lamps of the system is of the constant-current type, such as is commonly employed for supplying arc-lamps connected in series. I have shown three lamps 9, though my invention is obviously not limited to any specific number. It is desirable that each lamp shall have only one glower in operation at any one time, and I therefore provide each lamp with a plurality of glowers so designed and constructed with reference to each other or with reference to the heater, or both, that only one shall be conductive at any one time. This condition may be provided for either by making the glowers of such dimensions or material that they are adapted to different voltages or by locating them at different distances from the heater, so that only one will be heated to the conducting temperature.

I have shown in the drawings each lamp as having two glowers 10 and 11, the glower 10 being adapted for a higher voltage than the glower 11. Each lamp is also provided with a heater 12 and with a heater cut-out 13, as is usual in lamps of this character. More than two glowers may obviously be employed, if desired, and the arrangement may otherwise be modified from what is illustrated without departing from the invention.

As shown, the glowers 11 being adapted for relatively low voltage will be first lighted and will remain in service to the exclusion of the glowers 10 so long as the former remain intact. If, however, any one of the glowers 11 becomes broken, or if the circuit connections become otherwise ruptured, the other glower 10 will become the luminous body of the lamp, since it is maintained at a conducting temperature during the operation of the other glower.

In Fig. 4 I have shown four lamps 14 connected in series and adapted for operation in a constant-current circuit. With lamps operated under such conditions it would not be practicable to permit interruption of the circuit by the burning out of a glower for the reason that arcing would take place between the broken terminals of the glower or at some other point in the lamp, and this would prevent the cutting in of the heater. In order to avoid this difficulty, I employ in connection with each lamp an inductive resistance or choke-coil 15, connected in shunt to the glower

16 and ballast resistance 17, but in series with the coil 18 for operating the cut-out 19 to interrupt the circuit of the heater 20. In the operation of the lamp in series, as here indicated, it is extremely desirable that the heater cut-out shall act as soon as the glower begins to take any considerable amount of current. In order to make the cut-out sufficiently sensitive to insure the prompt action of the cut-out desired, and thus avoid the possibility of simultaneous operation of heaters and glowers in multiple, I connect one of the stationary terminals of the cut-out 19 to a suitable point 21 intermediate the ends of coil 18, thus placing the portion 22 of the coil in series with the heater when it is in circuit. If the coil portion 22 is made of such proportions that the current through it exerts a pull that is almost sufficient to actuate the cut-out, a small amount of current through the glower and the entire coil 18 will be sufficient to actuate the cut-out. The portion 22 of the coil 18 is operatively independent of the other portion as far as the heater-current is concerned, and it may not only be considered as a separate coil, but may, in fact, be made and used as a separate coil, if desired. With the arrangement shown if a glower burns out the continuity of the circuit will be maintained through the corresponding shunt resistance 15, and as this is in series with the actuating-coil 18 the heater will not be cut into circuit. With a constant-current system the ballast resistance may be omitted; but if omitted from the system illustrated in Fig. 4 the shunt resistance 15 would still have the same circuit connections with reference to the glower and the cut-out-actuating coil.

In Fig. 5 the lamps 23 are of the same construction and have the same circuit connections as the lamps shown in Fig. 4, except that a single large ballast resistance 24 is employed in lieu of a separate ballast resistance for each lamp. With this arrangement I also provide a shunt resistance 25 for the ballast 24. In this case if the ballast 24 becomes destroyed the circuit will be maintained with slightly less than the normal amount of current by means of the shunt resistance 25—that is to say, the lamps are run at a slightly-lower efficiency than is usual in order that they may not be endangered by the cutting out of the corrective ballast.

In order to guard against the removal of the proper corrective ballast from the circuit in case of accident, I may employ the form of device shown in Fig. 6, in which there are two ballast resistances 26 and 27, the former of which is connected in series with the coil 28 and a cut-out 29 and the latter of which is connected in series with the contact-terminals of the cut-out. It will be seen that with this arrangement, provided the ballasts are properly designed, the ballast 26 will operate as a corrective device so long as it remains intact,

and the current acting in coil 28 will serve to interrupt the circuit of the ballast 27. If, however, the ballast 26 becomes destroyed, the cut-out will be closed, and thus cut ballast 27 into circuit. Since there may be a tendency to produce and maintain an arcing at the break in the ballast 26 when a very high potential is employed, I provide a small spark-gap 30 in shunt to the stationary contact-terminals of the cut-out 29. This spark-gap should be sensitive—that is to say, its terminals should be of small area and close together. Such being the case if there is any tendency to maintain the continuity of the circuit through the actuating-coil and the broken ballast a rise of potential will occur at the spark-gap 30, which will immediately shunt the current from the point where the arc is established, and thus release the cut-out and cause it to close, thereby in turn diverting the energy from the spark-gap 30.

While I have shown and described certain modifications of my invention, I desire it to be understood that the invention is not necessarily restricted thereto.

I claim as my invention—

1. The combination with a plurality of electric lamps of the type described connected in series with each other and each having a glower, a heater and an electromagnetic heater cut-out, of a resistance-coil connected in shunt to the glower and heater and in series with a cut-out coil of each lamp.

2. The combination with a plurality of electric lamps of the type described connected in series with each other and each having a glower, a ballast resistance, a heater and an electromagnetic heater cut-out, of a resistance-coil connected in shunt to the glower,

ballast and heater and in series with a cut-out coil of each lamp.

3. In a system of electrical distribution, a plurality of electric lamps of the type described connected in series, each of which has a cut-out coil in series with the heater and a cut-out coil in series with the glower.

4. In a lamp of the type described, the combination with a glower and a heater, of a cut-out having a coil in series with the heater and a coil in series with the glower.

5. In a lamp of the type described, the combination with a glower, a heater and a ballast, of a heater cut-out having an actuating-coil in series with the glower a portion of which is also in series with the heater.

6. In a system of electrical distribution, a plurality of electric lamps connected in series each of which has a glower, a heater, a cut-out coil in series with the heater, a cut-out coil in series with the glower and a resistance-coil connected in shunt to the glower and heater and in series with the cut-out coil.

7. In a system of electrical distribution, a plurality of electric lamps connected in series each of which has a glower, a heater, a ballast, a heater cut-out having an actuating-coil in series with the glower, a portion thereof being also in series with the heater, and a resistance-coil connected in shunt to the glower, ballast and heater and in series with the actuating-coil of the heater cut-out.

In testimony whereof I have hereunto subscribed my name this 31st day of October, 1900.

ALEXANDER JAY WURTS.

Witnesses:

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